Report_for_assignment4

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1. Usage:

(1) Run:

After decompressing the compressed file, use command cd enter into the folder. Use command "make" to compile all the files. Use command "./main" to run the program.

(2) Operations in the program:

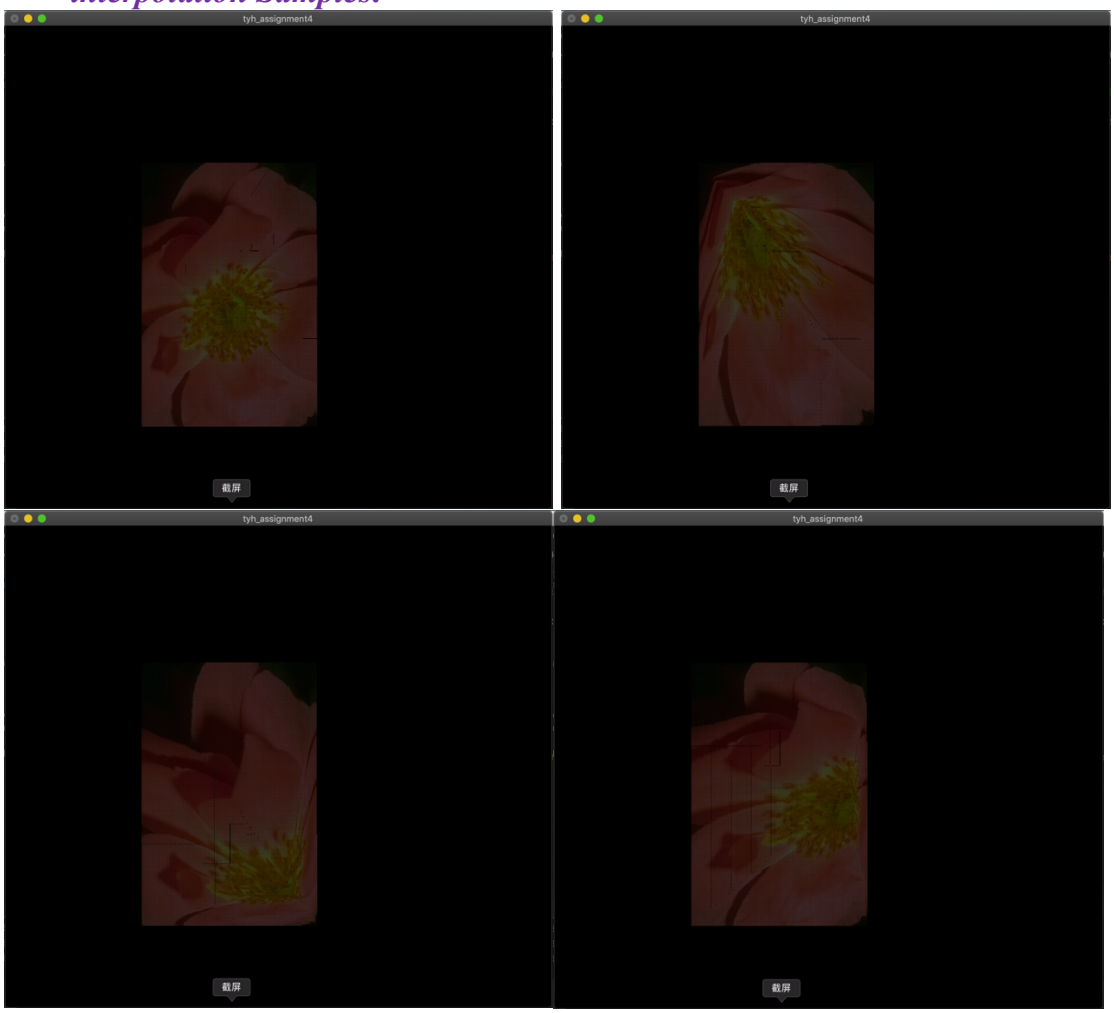
(i) After running the game, the flower.bmp will show in the window and ***start rotating automatically. The flower will stop rotating after rotating 360 degree.***

By using void timerFunc(int){} and in main function :glutTimerFunc(33, timerFunc, 1) to recall timerFuncmany(int) times to implement automatically rotation.

(ii) Interpolation : implemented by BaryCentric method.

You can click the left button of the mouse, then you can move the mouse in the flower picture.

interpolation Samples:



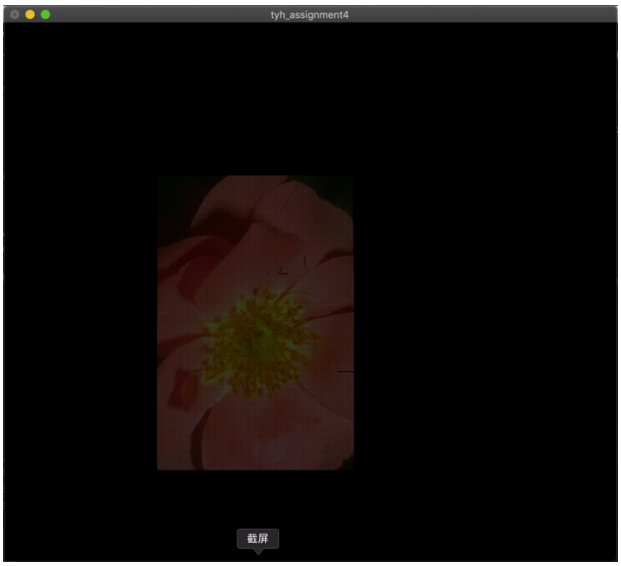
Because the method we used is to separate the recatangle into four triangles, BaryCentric interpolation method is suitable.

(iii) Keyboard functions:

You can press different keys to switch in different patterns:

For .bmp:

key f : switch to Flower pattern. And you can keep doing interpolation.

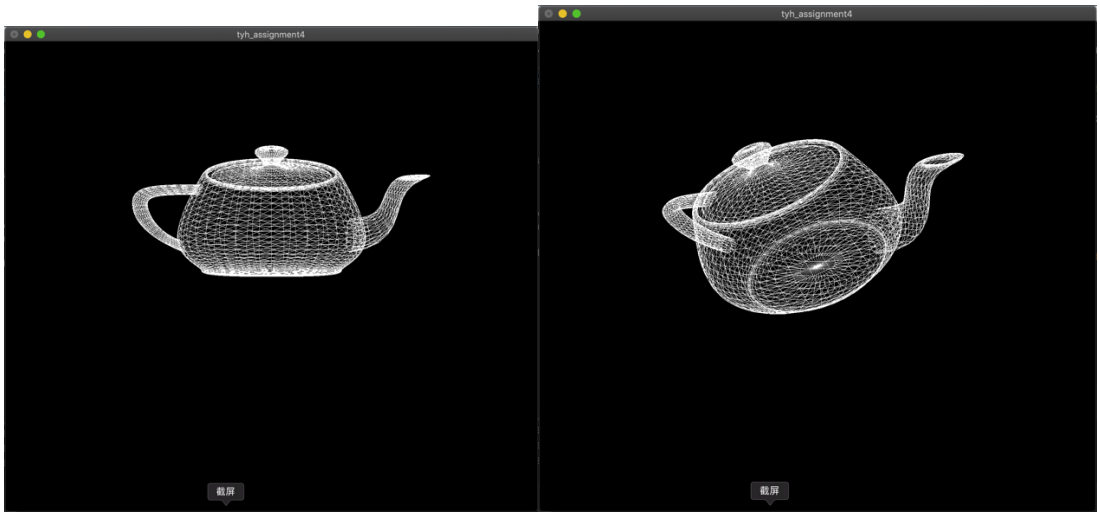


For .obj:

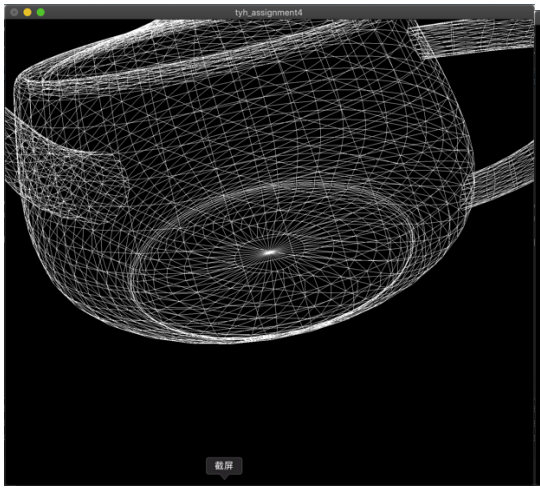
In following patterns, you can use key:

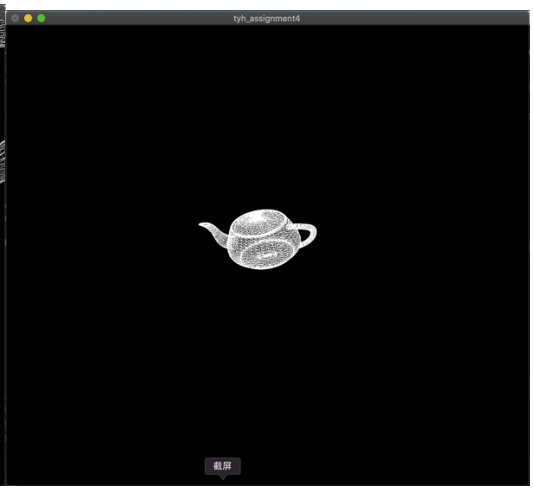
key 'a' to zoom in;
key 'o' to zoom out.

key t: switch to teapot pattern.



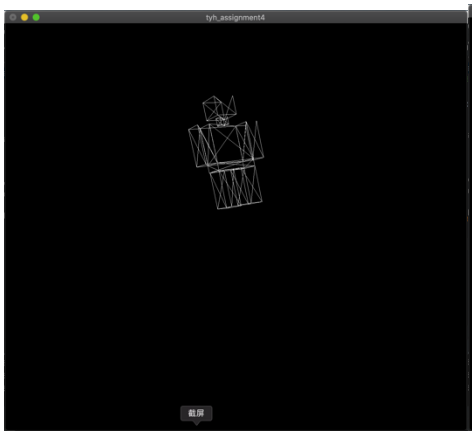
teapot.obj **teapot.rotation**

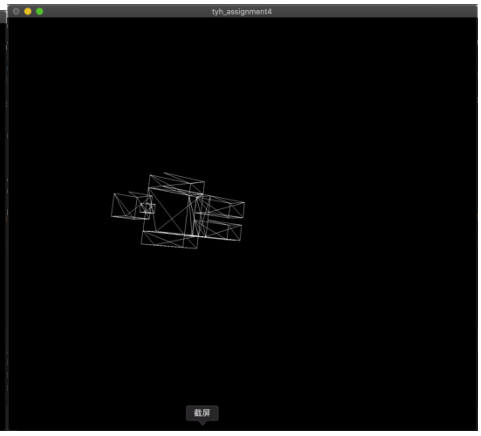




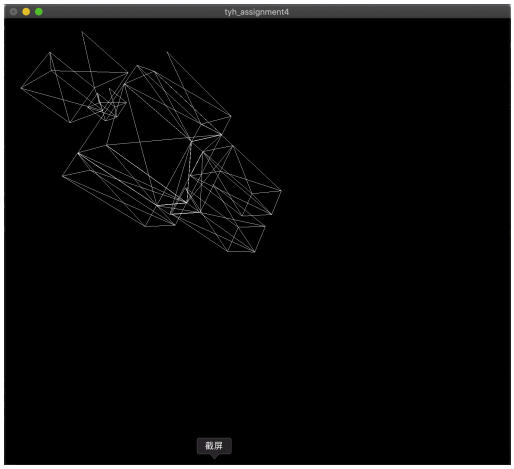
teapot zoomin **teapot zoom out**

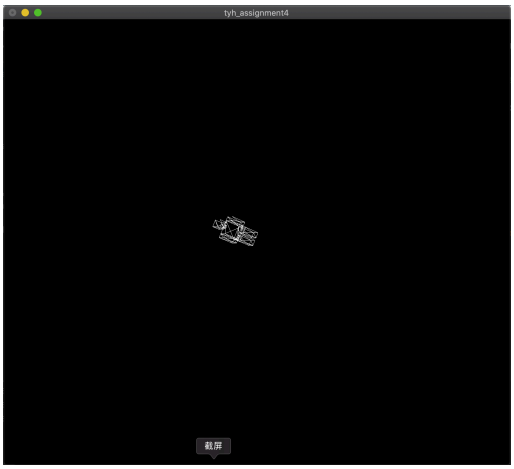
key b: switch to robot pattern.





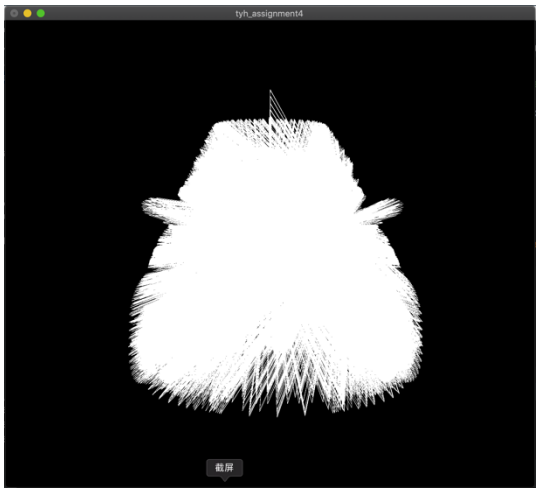
robot.obj **robot rotation**



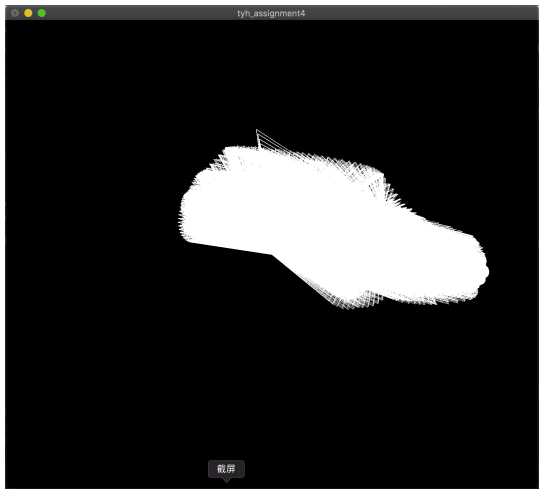


robot zoom in **robot zoom out**

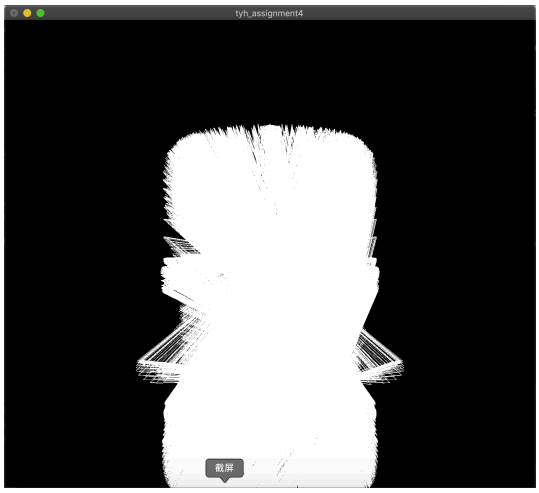
key c: switch to car pattern.



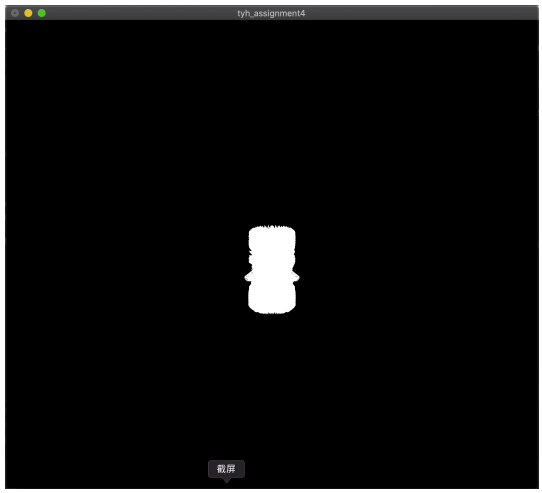
car.obj



car.rotation



zoom in



zoom out

Exit：

Press right button of the mouse to call the menu, press the exit button to exit.

2. Basic data structure:

Basic classes: implemented in basic.cpp.

(1) class Point

```
{
public:
    int x, y;
    Point() = default;
    Point(int x_input, int y_input){
        x = x_input; y = y_input;
    }
    void rotate(Point origin, float angle){
        double s = sin(angle * M_PI/180);
        double c = cos(angle * M_PI/180);
        double delta_x = (x -origin.x)*c - (y - origin.y)*s;
        double delta_y = (x -origin.x)*s + (y - origin.y)*c;
```

```
            x = int(delta_x + origin.x);
            y = int(delta_y + origin.y);
        }
};
(2) class BaryCentric{
public:
        float l1, l2, l3; /// three members : lambda 1,lambda 2, lambda3
        BaryCentric() = default;
        BaryCentric(float lambda1, float lambda2, float lambda3){
            l1 = lambda1; l2 = lambda2; l3 = lambda3;
        }
};
(3) class Pixel{
public:
        unsigned char r, g, b;
        Pixel() = default;
        Pixel(unsigned char red, unsigned char green, unsigned char blue){
            r = red; g = green; b = blue;
        }
};
(4) class Triangle{
public:
        Point p1{}, p2{}, p3{};
        float rot = 0;
        vector<pair<BaryCentric, Pixel>> texture;
        Triangle() = default;
        Triangle(Point point1, Point point2, Point point3){
            p1 = point1; p2 = point2; p3 = point3;
        }
        /// Check if p3 in the right triangle, argument p3
        bool if_point_in_triangle(Point);
        /// bary <-> standard, change of coordinate
        Point convert_to_standard(BaryCentric);
        BaryCentric convert_to_bary(Point);
        /// draw triangles, arguments : x and y
        void draw(int, int);
};
(5) class Flower{
public:
        int offset_x = 200;
        int offset_y = 200;
        int rot{};
        int width{}, height{};
        Point current_click{};
```

```
    vector<vector<Pixel>> pixels;
    vector<Triangle> triangles;
    Flower();
    void read(char*);
    void make_texture();
    void draw(); /// using triangle.draw to draw four triangles.
    /// In mouse and move function, passing current_click_point to point 3 to build new triangels.
    void current_click_point(Point);
};
```

3. Main function:

(1) Mouse functions:

    void mouse(int button, int state, int x, int y) and void move(int x, int y)

(2) Keyboard functions:

    void key(unsigned char key, int x, int y);
    void key_up(unsigned char key, int x, int y);

(3) Menu Function:

    void CreateMenu(void)
    void MenuItemClicked(int Value)

(4) Automatically rotation:

    void timerFunc(int)